

# Remote Management of a Cardiac Magnetic Resonance Imaging Session by a Low Cost Teleconsulting System

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**Introduction.** Telemedicine has been widely indicated as an effective way to improve the quality and to reduce the cost of health care delivering by a better employment of resources and professional health care providers time. Nevertheless, in the past the teleconsulting systems high cost and reduced efficiency made difficult their economical justification. Today, the technology development and the equipment prices drop permit to evaluate well focused telemedicine solutions even for reduced volume problems. We describe herein the technical and economical evaluations we followed in the identification of a low cost teleconsulting system for Cardiac Magnetic Resonance Imaging (MRI).

**Present situation.** Our Institute ("Salvatore Maugeri" Foundation, Pavia, Italy) is a network of several Centres spread all over Italy. While some high-cost and resource demanding diagnostic and research devices (such as MRI) are installed in the main Centre of Pavia, some specialistic competences are distributed in the peripheral Centres. In our case, the Foundation's major Specialist in cardiac imaging is actually employed full-time in the Tradate Medical Centre, 70 km far from the Pavia Medical Centre. As a consequence, the cardiac MRI sessions are extremely reduced in number with negative impact both for the diagnostic and the research.

**Alternative solution.** We therefore decided to evaluate the feasibility of a teleconsulting system connecting the two Centres. Time recording of cardiac MRI examinations showed us that during the examination the cardiologist's presence is required only in the pre-scan phase which represents less than 30% of the scan overall duration (mean 65 minutes). The cardiologist evaluates scout images and suggests the correct arrangement of sequences and scanning plans. The remaining part of examination (full sequences acquisition, patient monitoring) is usually carried out by the MRI technician. By the teleconsulting system, the cardiologist located in the remote Centre can efficaciously guide the MRI technician. The MRI console scans are captured and sent to the workstation in the remote Centre. The technician and the specialist can discuss by phone the same image, can point out the region of interest by means of two pointers and then can find out the correct scanning plans. The cardiologist is thus involved only for the strictly needed time for the acquisition planning. Then, he can go back to the management of his local activities.

**Technical and functional evaluations.** From a technical point of view the system architecture is quite simple. The

only constraint we had to respect was that the lengthening caused by teleconsulting system should not exceed the 10% of the overall duration. Since the patient during the teleconsulting is physically placed into the magnet, a greater lengthening of examination is not desirable. MRI images (256x256x8 bits) are quickly captured by a frame grabber. Data transmission is realized over a standard BRI (128Kbps) ISDN line. Vocal communication between the technician and the cardiologist is guaranteed by a standard phone line. Estimating a mean of 50 images/examination to transmit, the mean prolongation introduced by data transmission remains acceptable (4 sec/image for a total of 3.3 minutes, without compression). Particular attention was also paid to software user interface and upgradability. It runs under MS-Windows on two PC-based workstation and includes full teleradiology features.

**Economical evaluation.** We compared the teleconsulting solution (A) with an hypothetical solution in which the specialist should effectuate a weekly transfer to the main Medical Centre to carry out cardiac MRI examinations (B). In our model, we consider a mean need of 1 Cardiac MRI session/week and an average of 5 exams/session for a total of 200 examination/year. We performed a cost-minimization analysis, considering the following items: cost of total specialist time required in A and B (US\$ 0.48/minute); cost of transfer time (2 hours/transfer) and travelling allowance (US\$ 53) in B, transmission and communication costs (ISDN/minute US\$ 0.47, voice/minute US\$ 0.29, system cost (US\$ 21208) amortization over 5 years in A). For this amount of procedures, the specialist's presence cost/examination in solution A results in US\$ 42 versus the US\$ 54 of solution B. The costs of the two solutions are equal at 140 procedures. Under this amount of work, the teleconsulting system has not justification from a strictly economical point of view. Moreover, we have to point out that, in the next future, with some additional hardware (x-ray film scanner), the same system will be employed also for radiology teleconsulting, which reinforces its pragmatic and economical justification.

**Conclusion.** We evaluated the feasibility of a teleconsulting system for the remote management of a Cardiac MRI between two Medical Centres of our Institution. Preliminary evaluations and trials showed that the system is technically efficient and, even for a limited amount of procedures, is the cheaper solution.